

FEDERAL AID IN SPORT FISH RESTORATION

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Ketchikan Sport Fish Development
Chinook Salmon Remote Sport Release

by
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F-26-R-1

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RESEARCH PROJECT SEGMENT

State: Alaska

Name: Southeast Sport Fisheries
Enhancement

Project: F-26-R-1

Study: B-1

Study Title: Chinook Salmon Remote Sport Release

Cooperator: Paul Novak

Period Covered: 1 October 1986 to 30 June 1987

ABSTRACT

Zero-check chinook salmon, *Oncorhynchus tshawytscha* (Walbaum), smolts were transported from Deer Mountain Hatchery in Ketchikan to two sites on Prince of Wales Island (Thorne and Crab Bays) for short-term marine rearing. This is the second and last year for the rearing and release program of zero-check chinook salmon. Local volunteers at Thorne Bay provided all the labor for the culturing of fish, while labor at Crab Bay (near Craig) was only supplemented by volunteers. The average fish weights at the start of the project were 4.0 and 4.1 g at Thorne and Crab Bays, respectively. At release, Thorne Bay fish averaged 10.1 g, while the Crab Bay fish averaged 9.0 g. At both sites, condition of the smolts was monitored through blood samples using an osmometer. The selection of these sites in 1985 was based on biological criteria and user-group needs. Returning adults will contribute to terminal sport fisheries at both sites. Remote-site releases are being tested as a method of dispersing hatchery production.

KEY WORDS: zero-check, chinook salmon, *Oncorhynchus tshawytscha*, rearing, southern southeast Alaska, FRED, sport fisheries, imprint, Deer Mountain Hatchery.

INTRODUCTION

Following short-term marine net-pen rearing and imprinting, approximately 131,000 zero-check chinook salmon, *Oncorhynchus tshawytscha* (Walbaum), smolts were released at Crab and Thorne Bays on Prince of Wales Island (Appendix A). Jeannie and Jim McFarland provided a moorage site next to their log-float residence in Thorne Bay. Mrs. McFarland provided cultural care to the rearing fish and was the primary cooperater for the community. Several Thorne Bay community residents were involved with the set up, transfer of fish, and general well being of the project again this year. Although there was a minimal amount of volunteer assistance at Crab Bay, Fisheries Rehabilitation, Enhancement, and Development (FRED) Division personnel stationed at the Klawock Hatchery were primarily responsible for the culture, maintenance, transfer, and release of the fish.

In 1987 the net-pen rearing began at Thorne and Crab Bays on 24 and 29 May, respectively, which was 1 month earlier than in the previous year. Inclement weather and conflicts with the school session reduced visitations to the Thorne Bay site from the previous year's level. An article in the Southeast Alaska Island News¹ accurately described the 1987 project and served the purpose of informing the public about its progress. Moreover, a progress report was presented to the Thorne Bay City Council by Jeannie McFarland concerning this year's Dingell-Johnson (D-J) project events and the future program.

The zero-check chinook salmon portion of this project will be concluded with the current year's releases. Evaluation of the returning adults will be possible because of the coded-wire tags (CWTs) implanted in the fingerlings. Adult returns are expected to contribute to terminal-area sport fisheries at each site.

¹Prince of Wales Island newspaper authored by Elaine Johnston, a Thorne Bay resident

Remote rearing and release of one-check chinook salmon may continue if D-J funding is available. The program objectives would essentially remain the same: provide hatchery chinook salmon to remote communities to enhance their sport fisheries.

RECOMMENDATIONS

1. Continue remote-site releases of one-check chinook salmon to improve the quality and quantity of sport fisheries in terminal areas.
2. Evaluate the results of the zero-check program located at Thorne and Crab Bays during the release years of 1986 and 1987. Utilize CWT recovery and creel-census programs to monitor charter-boat operators and recreational fishermen.
3. Release 2500 age-1.0 chinook salmon smolts from each of these two sites, at least until such time that returns from releases of zero-check smolts prove more or less effective.
4. In conjunction with blood-sodium and/or osmolality testing, osmocompetency of zero-check chinook salmon should be monitored prior to saltwater planting utilizing the salt-water challenge technique described by Clarke and Blackburn (1977). Marine rearing in saline conditions exceeding 20 ppt require blood-sodium levels below 175 mmol/liter or an osmolality of less than 368 mosmol/liter.

OBJECTIVES

1. Incubate and rear approximately 150,000 zero-check chinook salmon fry for release at two remote sites.

2. Tag representative groups of all chinook salmon released from remote sites by spring 1987.
3. Set up pens and other necessary rearing equipment prior to fish transport in May 1987.
4. Transport groups of at least 50,000 chinook salmon smolts to remote sites for rearing and release and work with volunteer groups that will rear fish at the remote sites.
5. Provide 2-4 weeks of marine rearing at remote sites and release approximately 50,000 healthy chinook salmon smolts at each site.

MATERIALS AND METHODS

Chinook salmon eggs were taken from the Deer Mountain Hatchery Unuk River brood stock in 1986; the eggs were incubated at Deer Mountain Hatchery using Heath[®] incubators (stacked) and standard techniques of FRED Division. By using chilled incubation water, we delayed emergence and ponding until 11 December 1986.

At ponding, the average fry weight was 0.5 g. On a diet of Oregon Moist Pellet (OMP), they grew to an average of 4.0 and 4.1 g by the end of freshwater rearing for respective groups at Thorne and Crab Bays. Prior to transport, both groups of fish were taken off feed for 72 hours. During the freshwater rearing period, a representative number of fish from each group was tagged with coded wire.

[®] Mention of commercial products or trade names does not constitute endorsement by ADF&G, FRED Division.

Blood-sodium analysis, using the saltwater-challenge technique, was applied to the project fish to determine osmocompetency (Clarke and Blackburn 1977). In 1987 a microosmometer was utilized to analyze blood samples; the results were correlated to the blood-sodium analyzer used in 1986 (Appendix B).

For transport of fish to the Prince of Wales Island sites, standard fiberglass tanks were fitted with aerators and bottled-oxygen life-support systems (Piper et al. 1982). The vehicle carrying the tanks was loaded onto the state ferry M/V Aurora and transported to the Hollis terminal on Prince of Wales Island. The vehicle was driven from Hollis to the Crab Bay site and then to the Phillips Cold Storage dock where the fish were put into a hexagonal floating Tess[®] net pen (10-m diameter x 2-m deep), which was moored off the Phillips Cold Storage pier for marine rearing. This net pen was fitted with a fish feeder developed by Sweeney Enterprises, Inc.[®] that was electronically set to distribute feed each daylight hour. The amount of feed and duration of each feeding period was adjustable.

The Thorne Bay group of fish was transported using methods similar to the Crab Bay group, except the trip was longer. The Tess pen was set up prior to delivery and moved to the concession boat-moorage dock in Thorne Bay. Fish were delivered from the transport tanks to the floating pen using a 15.2-cm- diameter hose. The loaded pen was towed with small boats and a commercial troller to the feeding site in Thorne Bay. The Thorne Bay volunteer in charge of the rearing operation was Jeannie McFarland; she also used an automatic-feeder system (Sweeney Enterprises, Inc.) as a backup method to hand feeding the fish. McFarland performed normal cultural activities that include picking mortalities, keeping records, computing feed rations, keeping the net clean, and serving as teacher and tour guide.

During rearing, blood, length/weight, and autopsy data (Appendix C) were collected after 21 or 23 days of feeding. At the end of

the rearing program, fish at both sites were subsampled for growth. A final blood-sodium sample was collected, and a fish-quality autopsy index (Goede 1985) was completed for both groups. A Yellow Springs Instrument[®] (Model 330) was used to collect salinity and water-temperature data. A Ryan Thermograph[®] (RTM) was used at Thorne Bay to collect daily surface-water temperatures. Both groups of fish were released in the evening on 29 June 1987. The pen and associated equipment from Crab Bay was dismantled, cleaned, and stored at the Klawock Hatchery; while the pen at Thorne Bay will be stored at the McFarland property. Alaska Dry Pellet (ADP) feed was used during the marine-rearing phase of this project.

RESULTS

Freshwater Culture

Deer Mountain Hatchery produced 161,202 zero-check chinook salmon smolts for the Thorne and Crab Bay projects. The freshwater rearing period extended over 170 days.

Coded-Wire Tagging

Between 21 and 29 April 1987, 41,510 chinook salmon presmolts were tagged with coded micro-wire; the tag codes by release site are provided in Table 1. The tagging process lasted 52.5 hours and involved three personnel. A tagging rate of 1,203 fish/hour produced a tag-retention rate of 96% for the 3-g presmolts.

Saltwater-challenge tests were applied to the fish on three different trial times to test their osmocompetency in terms of blood-sodium and osmolality levels. The first test was run prior to transport, while the second and third tests occurred under marine-rearing conditions; the results are provided in Table 2.

Table 1. Coded-wire tag summary for fish released at Thorne and Crab Bays in 1987.

Release site	Tag code	Number valid tags	Number invalid tags	Number of untagged represented
Thorne Bay	3B-13-8	18,785	1,285	62,927
Crab Bay - Craig	3B-14-8	13,371	190	34,907
		32,156	1,475	97,834

Table 2. Saltwater-challenge tests and associated blood-sodium and osmolality levels, 1987.

Date	Salinity (ppt)	BLOOD			
		<u>Na (mmol/l)</u> Range	x	<u>Osmolality (mosmol/l)</u> Range	x
5/22/87 ^{1/}	22.5	177.7-188.3	180.4	330-393	378
5/22/87 ^{2/}	22.5	157.6-193.0	174.4	335-402	367
5/22/87 ^{3/}	22.5	147.6-174.5	163.3	316-364	346
6/16/87 ^{1/}	27.0	160.8-202.0	175.9	341-419	370
6/15/87 ^{2/}	10.0	157.6-165.6	162.5	335-350	344
6/29/87 ^{1/}	27.0	157.1-179.8	164.2	334-357	347
6/29/87 ^{2/}	13.0	156.6-174.0	165.5	333-366	349

1/ Craig
2/ Thorne Bay
3/ Control

Vaccination

Between 16 and 17 May, all of the Deer Mountain Hatchery stocks scheduled for release were vaccinated for *Vibrio anguillarum*. They were immersed in Biovax[®], (Biomed Research Laboratories, Seattle, Washington) for 20 s (Wood 1974).

Transport of Fish

Salt (3%) was added to the transport water to reduce the effects of stress. Fish-loading densities were maintained at approximately 0.14 kg/liter (Piper al. 1982). Deer Mountain Hatchery's water temperature was 8.0°-8.3°C at both loadings. The transport-water temperature was chilled with ice and ranged between 8.0° and 9.0°C. Crab and Thorne Bays receiving water temperature was 10°C. Dissolved-oxygen (DO) levels were above 9 ppm; most readings were near the saturation levels.

The loading-transport time for the Crab Bay fish was 11 hours, while that for Thorne Bay fish was 10.5 hours. Mortalities were not evident when the Thorne Bay lot was unloaded, but approximately 3,000 mortalities occurred in the Crab Bay lot. Delivery was made at night at both pens using a 15.2-cm pipeline to the rearing pen; therefore, mortalities attributed to salinity shock on the morning of 26 May 1987 at Crab Bay masked the total transport-mortality accounting system.

Crab Bay Short-Term Rearing

Chinook salmon were delivered to Crab Bay on 25 May 1987; the 73,159 smolts appeared to be stressed in both the tank and net pen. On 27 May 1987 mortalities numbered 15,000 fish; the mortality rates dropped on the succeeding days, with less than 100/day occurring on 5 June 1987. The mortalities during the first 10 days were attributed to transport stress and lack of osmocompetancy. High-salinity readings ranging between 25% and

29% were monitored during the marine-rearing period at the standard 2-m depth. Mortality collections were made by dip net. Tagged and untagged mortalities were recorded: a total of 25,525 dead smolts was counted, representing a 35% loss; tagged mortalities represented 7,912 fish, or 69% of the dead fish. A marine release of 48,465 live fish resulted.

The automatic fish feeder, which was placed on the Tess pen frame, was equipped with a timer that controlled the duration of the feeding period as well as variable-throw mechanism; both features allowed complete feeding flexibility. The feeding rate was reduced over the first 6 days, because the fish were not feeding well and appeared to be in a state of shock. By 1 June, however, fish health had improved, and a full ration of feed was scheduled for the remainder of the rearing program. Based upon prior pen-feeding results at Thomas Basin, a ration consisting of 5% of the body weight was fed daily. Hourly feedings coincided with the daylight period; as many as 18 feedings were made between 0400 and 2200 h.

Growth summaries indicate the average weight at release was 9 g, while lengths ranging between 79 and 108 mm averaged 91 mm (Table 3). Food conversion for the Crab Bay fish was 2.92. A total of 581.5 kg of ADP (3/32-inch) was fed, producing a weight gain of 199.4 kg.

The Crab Bay chinook salmon smolts were sampled to obtain length/weight data and released at approximately 2300 h. Release was accomplished by removing the side apron and relaxing the walls on three sides of the pen. The weighted corners were raised; this crowded the fish toward the relaxed side and allowed them to swim out of the pen.

Table 3. Condition factors for the Crab Bay fish.

Date	Mean fork length (mm)	Mean weight (g)	K factor
5/22/87	71.50	4.19	1.2
6/16/87	77.14	5.33	1.2
6/29/87	91.00	9.00	1.2

Thorne Bay Short-Term Rearing

Some 87,287 chinook salmon smolts were delivered to the Thorne Bay net pen on 23 May 1987; the pen was temporarily moored overnight at the boat-moorage area. At 1100 h on 24 May, it was slowly moved to the permanent rearing site at the "McFarland's Floatel," located 3.2 km from the boat-moorage area. The fish arrived in good condition and began feeding aggressively at 1630 h. Only 244 mortalities were collected from the bottom of the pen after towing. After securing the net pen to the house float, Jeannie McFarland began the feeding regimen: 1-h intervals between 0400 and 2200 h. Over an 18-day period, an average of 18 feedings per day were made. The daily amount of feed was adjusted by calculating the weight gained and using a feed rate of 5% of body weight per day. The automatic fish feeder was placed on the Thorne Bay net-pen frame. This equipment was not used at the site in 1986, but based on the results of the pen-rearing of chinook salmon at Crab Bay in 1986; a decision was made to use the feeder at both sites. Because the automatic feeder was not broadcasting rations into the outer areas of the pen and the nonaggressive fish were not receiving rations, McFarland decided to hand-feed the fish during the day; however, she used the automatic feeder in the early morning and late-evening hours.

A total of 4,290 dead fish (representing a 5% mortality) was collected when they floated to the surface; of these, the number of tagged and untagged fish represented 37% (1,596) and 63% (2,694) of the mortality, respectively. A total of 82,997 live fish was released.

Growth summaries indicate the average weight at release was 11.0 g, while the average length was 96.5 mm; lengths ranged between 83 and 118 mm (Table 4). Food conversion for the Thorne Bay groups of fish was 0.95. These fish were fed a total of 861 kg of ADP (3/32-inch) formula, resulting in a weight gain of 909 kg.

Table 4. Condition factors for the Thorne Bay fish.

Date	\bar{x} Fork length (mm)	\bar{x} Weight (g)	K factor
5/22/87	72.30	4.13	1.1
6/15/87	75.88	5.18	1.2
6/29/87	96.60	10.95	1.2

On the 29 June release date, the smolts were sampled for length/weight data and blood-sodium levels and released at 1000 h. Release from the pen was accomplished in a manner similar to that occurring at the Crab Bay site. The released fish were observed feeding in McFarland Cove for several days after release. A record of water temperatures and salinities at both remote short-term-rearing sites is presented in Appendix D.

DISCUSSION

The second year of the chinook salmon remote-rearing project went extremely well at Thorne Bay; community involvement continued to be exceptional, while at Crab Bay community involvement was poor. A total of 160,464 fish were available from Deer Mountain Hatchery production; these fish were divided into discrete groups during the early freshwater-rearing stage. Thorne Bay received 87,305 fish, and Crab Bay received 73,159 fish. Both sites surpassed the 50,000 fish/site minimal objective; other objectives including tagging, transporting, and releasing were all met.

Fish health at Crab Bay was again questionable for the first 6 days of rearing; salinity shock and transport stress may have been a reoccurring problem in 1987. Mortality rates at Crab Bay were 35%, compared to only 5% at Thorne Bay. Salinities at Crab Bay ranged between 25‰ and 29‰, while Thorne Bay salinities ranged between 8‰ and 20‰. Water temperatures were comparable at both sites.

Mortalities at Crab and Thorne Bays occurred across the total size range. At Thorne Bay, we observed an increase in gut distention in the dying fish, and autopsies revealed compacted food, watery liquid, and probable gas formation in the stomach,

which are indicative of overfeeding. The 5% of body weight daily diet rations were reduced to 2%, and the mortalities declined.

Blood samples corroborated the lack of osmocompetancy and explained the subsequent high mortality rate in Crab Bay fish. Osmolality samples were processed before, during, and at the end of marine rearing. Crab Bay fish entered the marine environment with a total blood-osmolality level (378) greater than that of Thorne Bay (367). Midway through the marine-rearing project, osmolality levels of 369 and 344 were reported for Crab and Thorne Bays, respectively. Osmolality levels at release were 347 and 350 for Crab and Thorne Bays, respectively.

Denton (pers. comm.) correlates the osmolality results to the previously reported blood-sodium-analysis process and presents these relationships in Appendix D. A lower osmolality level means that fish are at or closer to osmocompetency, or full smoltification, than those with higher values.

Growth rates were different at the two sites and probably were influenced by salinity conditions that stressed the Crab Bay fish for 6 days. Growth summaries at release show average weights to be 9.0 g and 11.0 g for Crab and Thorne Bays, respectively. The Thorne Bay fish averaged 96.6 mm in length, while Crab Bay fish averaged 91.0 mm. Body-condition factors were the same for both groups of marine-reared fish.

Food-conversion rates varied considerably between the groups; a very good one occurred at Thorne Bay (0.95). The conversion rate at Crab Bay, however, was poor (2.92) but not unexpected if the effects of salinity shock are considered. Much of the food intake was probably utilized for combating stress and maintaining body weight during the first half of the rearing program, and the rest was wasted; therefore, limited growth occurred.

The general fish health and project results at Thorne Bay were much better than at Crab Bay. Food conversion at Thorne Bay improved this year, compared to the 1986 conversion rate of 1.6. this may have been influenced by the use of an automatic fish feeder, less human visitations to the pen, or some unidentifiable culture efficiency by McFarland.

As a footnote, sport fishermen have reported catching the tagged chinook salmon released in 1987. Recoveries of coded-wire-tagged fish 8 km from the pen site were made 1 week after release, demonstrating that the fish were moving along the Prince of Wales shoreline.

ACKNOWLEDGMENTS

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APPENDIX A

STANDARD PRODUCTION DATA FORMS

APPENDIX A

Form 8a: Fish Shipping Form

(Check one) ☐ Eggs ☐ Rearing ☒ Imprinting ☐ Release

I. GENERAL INFORMATION AND PLANTING DATA

Facility Deer Mountain Hatchery
Trip No. 1 Page No. 1 Using Division FRED
(Water Stocked)
Trip Date 05/23/87 Destination Thorne Bay
Type Water Estuary Region Southeast Community Thorne Bay
Plant ☐ Transfer ☒ Lot 1986 Chinook sal. Unuk R.
Brood year, Species, Origin
Age 0 Type Marks Ad CWT* Code No. 3B-13-8
Avg. Wt: (No./lb) 114 (Gm ea.) 4.13
Avg. Lt: (In.) 2.8 (Cm.) 7.04
Total Wt: (lbs) 767.8 (kg.) 348
NUMBER STOCKED (Live) 87,287 MORTALITIES 18
Condition Good Disease History None
Receiving
Water Temp: Hatchery 8.0 °C Water unknown °C
Tank Start unknown °C Tank End unknown °C
Weather & Estuarine Conditions at Destination
overcast - calm

Start of End of
Dissolved Oxygen: Haul unknown (mg/l) Haul unknown (mg/l)
Salinity at Release Site 20% (g/l)
Method of Transporting:
☐ Aircraft Tanks ☐ Bags/Boxes ☐ Skiffs/Boats
☐ Direct Release ☐ Flatbed Tanks ☐ Carriers
☐ Pickup Tanks ☒ Trailer Tanks ☐ Other

Comments:

II. ADDITIONAL TRANSFER DATA

Receiving Supervisor _____ Date Received / / Time _____ Pond/Pen No. _____

III. ADDITIONAL TRIP DATA

5/23 5/24
Depart Time 7:45p Time Planted 2:30a Vehicle No. _____ Mileage _____ Cost/mi _____
Load Time 1 hr Trip Time 6.75 hr Aircraft: ☐ Cost/hr _____ Time _____
(No. men 4) (No. men 4) Ferry: ☐ Cost _____ Barge: ☐ Cost _____
Oxygen Used _____
Transportation Supervisor D. Bright

IV. Remarks

* 20,279 Ad CWT
1,387 Ad
Corrected 65,621 Unmarked
7/22/87 87,287 Total

Brood Yr. 1986
Species Chinook salmo
Origin Unuk River
Lot No. _____
Stock Ketchikan Creek

[1:1:N] [2] [:::]:]
[:::]:] [::] [::]
[:::]:]:] [:::]:]:]
[] [:::]:]:]
[] [::] [::] [::]
[:::]:]:]:]
[:::]:]
[:::]:]:]
[:::]:]:] [:::]:]:]
(Condition) []
[:::] [:::]
[:::] [:::]
[:::]:]:]:] (Update) []
(CWT No.) [:::]:]:]

STANDARD PRODUCTION DATA FORMS

Page 1 of 1

Form 8a: Fish Shipping Form

(Check one) ☐ Eggs ☐ Rearing ☐ Imprinting ☒ Release

Brood Yr. 1986
Species Chinook salmon
Origin Unuk River
Lot No. _____
Stock Ketchikan Cree

I. GENERAL INFORMATION AND PLANTING DATA

Facility Deer Mountain Hatchery
Trip No. 1 Page No. 1 Using Division FRED
(Water Stocked)

Trip Date 06/29/87 Destination Thorne Bay
Type Water Estuary Region Southeast Community Thorne Bay
Plant ☒ Transfer ☐ Lot _____

Brood year, Species, Origin

Age 0 Type Marks Ad CWT Code No. 3B-13-8

Avg. Wt: (No./lb) 41.5 (Cm ea.) 10.95

Avg. Lt: (In.) 4.5 (Cm.) 9.65

Total Wt: (lbs) 2005 (kg.) 909.7

NUMBER STOCKED (Live) 82,997 MORTALITIES 4290

Condition Excellent Disease History Cert./vaccinated (Condition) ☐

Receiving

Water Temp: Hatchery 11.5 °C Water 11.5 °C

Tank Start _____ °C Tank End _____ °C

Weather & Estuarine Conditions at Destination _____

calm - sunny

Start of End of
Dissolved Oxygen: Haul 9 (mg/l) Haul 9 (mg/l)

Salinity at Release Site 13ppt (g/l)

Method of Transporting:

☐ Aircraft Tanks ☐ Bags/Boxes ☐ Skiffs/Boats
☐ Direct Release ☐ Flatbed Tanks ☐ Carriers
☐ Pickup Tanks ☐ Trailer Tanks ☐ Other

Comments: Marine rearing in a Tess pen located at Thorne Bay at the
McFarland Floatel.

II. ADDITIONAL TRANSFER DATA

Receiving Supervisor Novak Date Received 06/29/87 Time 8:00p Pond/Pen No. 1

III. ADDITIONAL TRIP DATA

Depart Time 8:00p Time Planted 8:00p Vehicle No. _____ Mileage _____ Cost/mi _____
Load Time _____ Trip Time _____ Aircraft: ☐ Cost/hr _____ Time _____
(No. men 6) (No. men _____) Ferry: ☐ Cost _____ Barge: ☐ Cost _____
Oxygen Used 0
Transportation Supervisor Paul Novak

IV. Remarks

Dropped the net and allowed chinook smolt to swim out naturally.

Form 8a: Fish Shipping Form

(Check one) ☐ Eggs ☐ Rearing ☒ Imprinting ☐ Release

I. GENERAL INFORMATION AND PLANTING DATA

Facility Deer Mountain Hatchery
Trip No. 1 Page No. 1 Using Division FRED
(Water Stocked)

Trip Date 05/25/87 Destination Craig
Type Water salt Region Southeast Community Craig
Plant ☐ Transfer ☐ Lot _____

Brood year, Species, Origin
Age 0 Type Marks Ad CWT* Code No. 3B-14-8
Avg. Wt: (No./lb) 110 (Cm ea.) 4.19
Avg. Lt: (In.) 2.8 (Cm.) 7.15
Total Wt: (lbs) 675 (kg.) 306
NUMBER STOCKED (Live) 73,897 MORTALITIES 10
Condition Good Disease History None

Receiving
Water Temp: Hatchery 8.3 °C Water unknown °C
Tank Start unknown °C Tank End unknown °C
Weather & Estuarine Conditions at Destination
overcast - cool - slight breeze

Start of End of
Dissolved Oxygen: Haul unknown (mg/l) Haul unknown (mg/l)
Salinity at Release Site unknown (g/l)
Method of Transporting:
☐ Aircraft Tanks ☐ Bags/Boxes ☐ Skiffs/Boats
☐ Direct Release ☐ Flatbed Tanks ☐ Carriers
☐ Pickup Tanks ☒ Trailer Tanks ☐ Other

Comments: _____

II. ADDITIONAL TRANSFER DATA

Receiving Supervisor _____ Date Received / / Time _____ Pond/Pen No. _____

III. ADDITIONAL TRIP DATA

5/25 5/25
Depart Time 4:15p Time Planted 11:45p Vehicle No. _____ Mileage _____ Cost/mi _____
Load Time 1.25 hr Trip Time 7.5 hr Aircraft: ☐ Cost/hr _____ Time _____
(No. men) (No. men 3) Ferry: ☐ Cost _____ Barge: ☐ Cost _____
Oxygen Used _____
Transportation Supervisor D. Bright

IV. Remarks

* 20,341 Ad CWT
301 Ad
52,517 Unmarked
73,159 Total
Delivered to Crab Bay

STANDARD PRODUCTION DATA FORMS

Page 1 of 1

Form 8a: Fish Shipping Form

Brood Yr. 1986
Species Chinook salmon
Origin Unuk River
Lot No. _____
Stock Ketchikan Creek

(Check one) ☐ Eggs ☐ Rearing ☐ Imprinting ☒ Release

I. GENERAL INFORMATION AND PLANTING DATA

Facility Deer Mountain Hatchery
Trip No. 1 Page No. 1 Using Division FRED
(Water Stocked)

Trip Date 06/29/87 Destination Crab Bay
Type Water _____ Region Southeast Community Craig
Plant ☒ Transfer ☐ Lot _____

Brood year, Species, Origin

Age 0 Type Marks Ad CWT Code No. 3B-14-8

Avg.Wt: (No./lb) 50.4 (Gm ea.) 9.0

Avg.Lt: (In.) 3.75 (Cm.) 9.1

Total Wt: (lbs) 965.6 (kg.) 437.9

NUMBER STOCKED (Live) 48,465 MORTALITIES 24,694

Condition Good Disease History Cert./vaccinated

Receiving

Water Temp: Hatchery 13 °C Water 13 °C

Tank Start _____ °C Tank End _____ °C

Weather & Estuarine Conditions at Destination _____

calm - evening hours.

Start of

End of

Dissolved Oxygen: Haul 9 (mg/l) Haul 9 (mg/l)

Salinity at Release Site 27 ppt (g/l)

Method of Transporting:

☐ Aircraft Tanks ☐ Bags/Boxes ☐ Skiffs/Boats
☒ Direct Release ☐ Flatbed Tanks ☐ Carriers
☐ Pickup Tanks ☐ Trailer Tanks ☐ Other

(Update) ☐
(CWT No.) _____

Comments: Marine rearing in a Tess pen located at Crab Bay at the
Phillips coldstorage area.

II. ADDITIONAL TRANSFER DATA

Receiving Supervisor Novak Date Received 06/29/87 Time 11:00p Pond/Pen No. 1

III. ADDITIONAL TRIP DATA

Depart Time 11:00p Time Planted 11:00p Vehicle No. _____ Mileage _____ Cost/mi _____

Load Time _____ Trip Time _____ Aircraft: ☐ Cost/hr _____ Time _____

(No. men _____) (No. men _____) Ferry: ☐ Cost _____ Barge: ☐ Cost _____

Oxygen Used 0

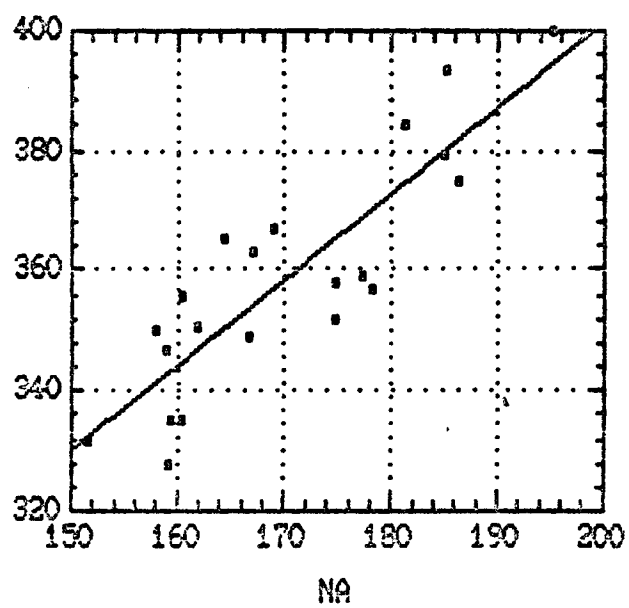
Transportation Supervisor Mike Ward

IV. Remarks

Dropped the net and fish allowed to naturally swim out of the pen.

APPENDIX B

Regression of osm on NA



APPENDIX C

AUTOPSY CRITERIA

<u>Length:</u>	Fork length in millimeters (tip of snout to fork of tail)
<u>Weight:</u>	Weight in grams
<u>K_{fl}:</u>	$= \frac{W \times 10^5}{L^3} \quad \text{(a calculated field)}$
<u>Fins:</u>	0 - normal, healthy fin 1 - frayed, damage probably reversible 2 - eroded, less than 1/3 of fin gone 3 - severely eroded, more than 1/3 of fin gone 4 - fin missing or severely misshapen
<u>Descaling:</u>	Percent of descaling, 0 to 100
<u>Operculum:</u>	Normal (0), shortened - gill fringe visible (1), 25% or more missing-large amount of gill visible (2)
<u>Eyes:</u>	Normal (N), Exophthalmia (E1, E2), Hemorrhagic (H1, H2), Blind (B1, B2), Missing (M1, M2), Cataract (C1, C2)
<u>Gills:</u>	Normal (N), Frayed (F), Clubbed (C), Marginate (M), Pale (P)
<u>Pseudobranchs:</u>	Normal (N), Swollen (S), Swollen & Inflamed (SI), Inflamed (I)
<u>Thymus:</u>	No hemorrhage (0), Mild hemorrhage (1), Severe hemorrhage (2)
<u>Mesenteric Fat:</u>	Internal body fat expressed with regard to amount present:
	<u>Caecal Fat:</u>
	0 - none
	1 - less than 50% of each caecum is covered
	2 - 50% of each caecum is covered
	3 - more than 50% of each caecum is covered
	4 - pyloric caeca completely covered by large amount of fat
	<u>Visceral Fat:</u>
	A - 50% or less of available body cavity occupied by fat
	B - more than 50% of available body cavity occupied by fat
	C - visceral fat produces externally noticeable bulge in whole fish
<u>Spleen:</u>	Black (B), Red (R), Granular (G), Nodular (Nod), Enlarged (E)
<u>Hind Gut:</u>	No inflammation (0), mild inflammation (1), severe inflammation (2)
<u>Kidney:</u>	Normal (N), Swollen (S), Mottled (M), Granular (G),
<u>Liver:</u>	A - Normal, firm, red color B - Pale C - Fatty liver, coffee-cream color, greasy to feel D - Nodules in liver E - Focal discoloration F - Slight general discoloration G - Hemorrhage
<u>Gall Bladder:</u>	Normal (N), Enlarged (E), Green (G), Red (R), Very dark color (D)
<u>Mesentery:</u>	No inflammation (0), mild inflammation (1), severe inflammation (2)
<u>Blood:</u>	<u>Hematocrit:</u> Volume of red blood cells (erythrocytes) express as percent of total blood volume. Centrifuged 5 minutes. <u>Leucocrit:</u> Volume of white blood cells (leucocytes) expressed as percent of total blood volume. <u>Plasma Refraction:</u> Amount of protein and triglycerides in plasma, expressed as gram percent. Determined with hand protometer.

SUMMARY OF FISH AUTOPSIES

Date: 22-May-87
 Location/Species: DMH Chinook BY 86
 Group: Remote Rel - Thorne Bay
 Investigator(s): Denton/Parsley

Reason for Sample: Transfe
 saltwater net pens
 Sample No. 1

	Mean Value	Coefficient of Variation
Length	71.55	0.056
Weight	4.1175	0.157
K	1.1165	0.059
Hematocrit	42.5	0.111
Leucocrit	0.395	1.175
Serum Refraction	8.22	0.214
Fin Index	0	
Descaling	0.45 %	
Operculum	0	
Thymus	0.1	
Eyes - % of fish:		Spleen - % of fish:
n 95		r 100
e1 0		b 0
e2 0		g 85
h1 5		n 0
h2 0		e 0
b1 0		
b2 0		Kidney - % of fish:
m1 0		n 100
m2 0		s 0
		m 0
		g 0
Gills - % of fish:		Liver- % of fish:
n 100		a 10
f 0		b 55
c 0		c 35
m 0		d 0
p 0		e 0
		f 0
Pseudobranchs - % of fish:		g 0
n 35		
s 65		Gall bladder - % of fish:
i 0		n 45
si 0		e 40
Caecal Fat - mean value 1.1		r 15
Visceral Fat - % of fish:		g 0
a 60		d 0
b 40		
c 0		
Hind Gut - mean value 0.2		
Mesentery - mean value 0.0		

SUMMARY OF FISH AUTOPSIES

Date: 29-Jun-87
 Location/Species: DMH Chinook BY 86
 Group: Remote Rel - Thorne Bay
 Investigator(s): Novak/Denton/McFarland

Reason for Sample: Release
 saltwater net pen
 Sample No. 2

	Mean Value	Coefficient of Variation
Length	96.15	0.090
Weight	10.95	0.323
K	1.2032	0.142
Hematocrit	ERR	ERR
Leucocrit	ERR	ERR
Serum Refraction	ERR	ERR
Fin Index	0.05	
Descaling	0.95 %	
Operculum	0	
Thymus	0.1	
Eyes - % of fish:		Spleen - % of fish:
n 80	c1 15	r 100
e1 0	c2 5	b 0
e2 0		g 5
h1 0		n 0
h2 0		e 0
b1 0		
b2 0		Kidney - % of fish:
m1 0		n 100
m2 0		s 0
		m 0
Gills - % of fish:		g 0
n 95		
f 0		Liver- % of fish:
c 0		a 35
m 0		b 35
p 5		c 30
		d 0
Pseudobranchs - % of fish:		e 0
n 90		f 0
s 10		g 0
i 0		
si 0		Gall bladder - % of fish:
		n 90
Caecal Fat - mean value 1.5		e 10
Visceral Fat - % of fish:		r 0
a 50		g 0
b 50		d 0
c 0		
Hind Gut - mean value 0.0		
Mesentery - mean value 0.0		

SUMMARY OF FISH AUTOPSIES

Date: 22-May-87
 Location/Species: DMH Chinook BY 86
 Group: Remote Rel - Craig
 Investigator(s): Denton/Parsley

Reason for Sample: Transfe
 saltwater net pens
 Sample No. 1

	Mean Value	Coefficient of Variation
Length	71.5	0.048
Weight	4.21	0.188
K	1.1389	0.067
Hematocrit	41.631	0.123
Leucocrit	0.6642	1.322
Serum Refraction	9.385	0.163

Fin Index	0
Descaling	0.3 %
Operculum	0
Thymus	0.3

Eyes - % of fish:

n	95
e1	0
e2	0
h1	5
h2	0
b1	0
b2	0
m1	0
m2	0

Gills - % of fish:

n	100
f	0
c	0
m	0
p	0

Pseudobranchs - % of fish:

n	35
s	65
i	0
si	0

Caecal Fat - mean value 1.6

Visceral Fat - % of fish:

a	25
b	75
c	0

Hind Gut - mean value 0.3
 Mesentery - mean value 0.0

Spleen - % of fish:

r	100
b	0
g	95
n	0
e	0

Kidney - % of fish:

n	100
s	0
m	0
g	0

Liver- % of fish:

a	20
b	80
c	0
d	0
e	0
f	0
g	0

Gall bladder - % of fish:

n	95
e	0
r	0
g	0
d	0

SUMMARY OF FISH AUTOPSIES

Date: 29-Jun-87
 Location/Species: DMH Chinook BY 86
 Group: Remote Rel - Craig
 Investigator(s): Novak\Ward\Denton

Reason for Sample: Release
 saltwater net pen
 Sample No. 2

	Mean Value	Coefficient of Variation
Length	91.25	0.071
Weight	8.975	0.240
K	1.1604	0.047
Hematocrit	ERR	ERR
Leucocrit	ERR	ERR
Serum Refraction	ERR	ERR
Fin Index	0.35	
Descaling	1.85 %	
Operculum	0	
Thymus	0.05	

Eyes - % of fish:

n	20	c1	20
e1	0	c2	60
e2	0		
h1	0		
h2	0		
b1	0		
b2	0		
m1	0		
m2	0		

Gills - % of fish:

n	75
f	0
c	25
m	0
p	0

Pseudobranchs - % of fish:

n	100
s	0
i	0
si	0

Caecal Fat - mean value 0.9

Visceral Fat - % of fish:

a	85
b	15
c	0

Hind Gut - mean value 0.0

Mesentery - mean value 0.0

Spleen - % of fish:

r	100
b	0
g	0
n	0
e	0

Kidney - % of fish:

n	100
s	0
m	0
g	0

Liver- % of fish:

a	30
b	20
c	50
d	0
e	0
f	0
g	0

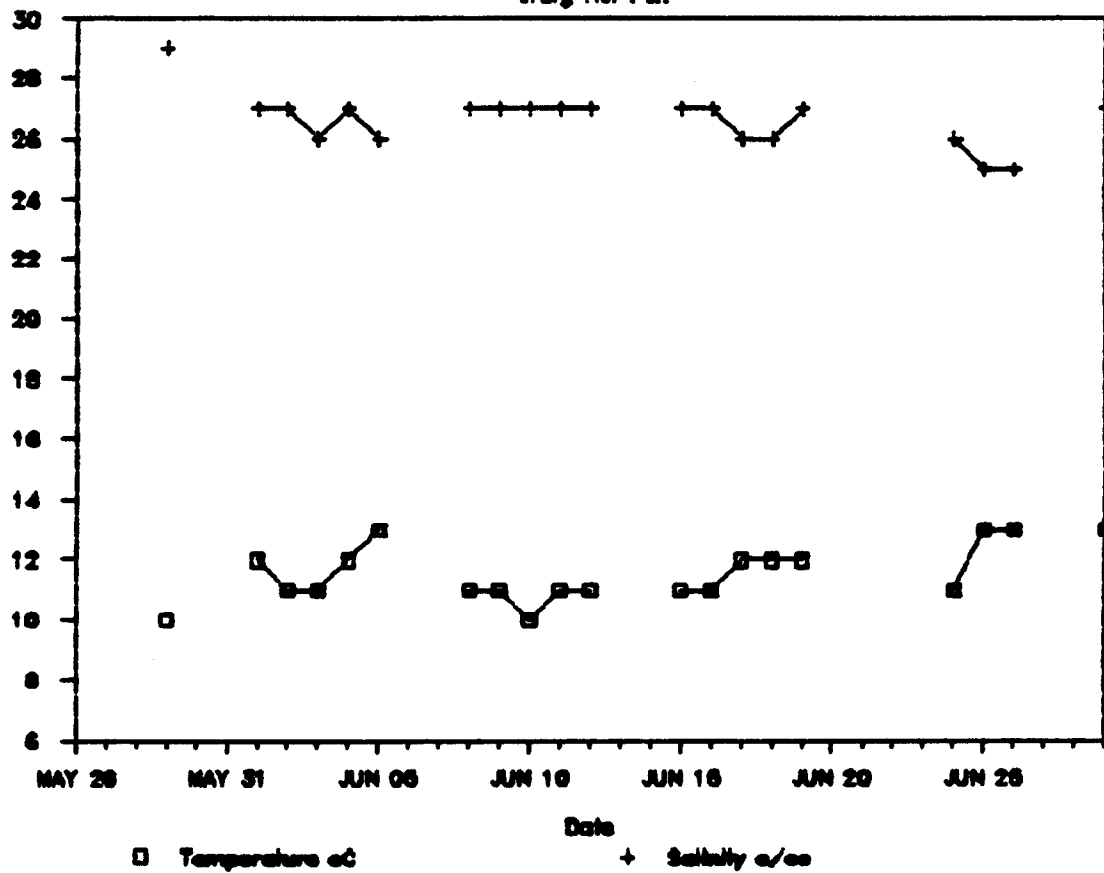
Gall bladder - % of fish:

n	95
e	0
r	5
g	0
d	0

APPENDIX D

TEMPERATURE & SALINITY

Craig Not Pen



TEMPERATURE & SALINITY

Thorne Bay Net Pan

